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Anglo-American Co-operation

The decision has been taken by the Government to create, in association with the United States, a joint council to promote a higher manufacturing output from British industry. It can of course be presumed that the survey to be made will include the foundry industry. We are enthusiastically in favour of international co-operation for technical and industrial advancement. So too are most foundry executives, as the annual exodus to foreign industrial centres well shows. The case is altered when co-operation is to be instituted between the representatives of the two industries as a whole—then, we doubt its efficacy. Here, for each industry, statistics can be provided which no doubt will throw into relief the superiority of American output per man-hour. We venture to suggest, however, that industrial statistics are useless and misleading for such a purpose. Applying them to ironfounding, we personally find the addition of boot protectors, tunnel segments, half-inch chain links, ingot moulds, motor car cylinders, lathe beds, and every other variety of casting, gives a figure which is related to one returned earlier or later, but that is all. Only the other day, a professor was pointing to the fact that one district of the country (which incidentally is amongst the best from an intrinsic output point of view) was producing a lower output per man than the balance of the country. The answer is so simple; the area under consideration happens to make a lighter class of casting than other areas.

By now, the basic principles of management are well understood. Moreover, examples of their application have constituted an imposing section of the technical Press for many years. What then can the new Council do to help to improve output? The following suggest themselves: (1) Trespass still more on the generosity of American industrialists in the opening of the factories for inspection. (2) Bring pressure of our Government to relax the capital expenditure ban, so that new machinery can be bought. (3) Get everybody to agree to the suppression of restrictive practices. (4) Ensure that industry receives an adequate amount of raw materials at an economic price. We doubt if any council would have the time to investigate in detail the workings of any particular industry.

The two countries are not, never were, and never will be industrially comparable. The U.S.A. is a continent, with a very large home market. Its largest motor-car factory will be the equal of our whole industry. One group of iron and steel works will be similarly placed. It possesses unlimited supplies of natural gas and other raw materials. On the other hand, the United Kingdom has the advantage of short haulages from factory to market. Whilst the operatives of both countries are keen on the weekly pay packet, yet it is possible that it has a stronger pull in the States. The pundits used to imagine that there was need to educate the masses as to how best to spend their leisure time. The miners at least seem to have found a solution which satisfies them. If only the new Council can evolve a new and generally accepted system of human relationships in industry, then they can dissolve themselves, well knowing they have accomplished much.

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Council of Ironfoundry Associations

Modernisation Schemes

The Council of Ironfoundry Associations draws attention to the fact that many modernisation schemes are still being sent through the old channels to one or other of the Ministries, and in consequence there is sometimes an appreciable delay before the details of a scheme reach the Steering Committee of the Joint Iron Council. Schemes for modernisation or extension which Member-Firms wish to have approved must first pass before the Steering Committee. This procedure has been agreed with the Iron and Steel Board. If any firm sends the papers relating to a scheme either to the Board of Trade, the Regional Controller, the Ministry of Works, the Iron and Steel Board or any other section of the Ministry of Supply, time is wasted while the application is being forwarded to the right quarter. In some cases the papers have passed through five sets of hands before they have reached the Steering Committee, and the time which has been lost has been from three to four weeks. It will be appreciated that the Steering Committee can do nothing to expedite the approval of a scheme of which it has received no intimation, and Member-Firms are, therefore, urged to follow carefully the details of procedure already indicated.

Employment Statistics

There was very little change compared with the previous month's figure. Details of the distribution of labour in the industry according to district at June 5 are shown below:—

Area.	Process and maintenance workers.		Clerical workers.		Total.
	Male.	Female.	Male.	Female.	
London	7,738	158	154	87	8,137
Eastern	4,884	285	147	60	5,376
Southern	1,978	61	58	23	2,120
South Western ..	3,574	169	91	35	3,869
Midlands	30,122	2,682	827	804	34,435
North Midlands ..	17,587	1,096	675	335	19,693
E. and W. Ridings of Yorks.	14,268	714	367	201	15,550
Scotland	19,458	875	685	464	21,482
Wales	3,472	200	110	49	3,831
North Western ..	19,143	702	468	209	20,522
Northern	8,399	457	278	125	9,259
Northern Ireland ..	1,882	—	29	2	1,913
Total	132,505	7,399	3,889	2,394	146,187

Cost Ascertainment Methods

To assist lecturers on the C.F.A. Costing Report, the Secretary has had the principal charts and tables of the Report reproduced on 35 mm. film, in which form they may be conveniently displayed on a screen by means of any normal film-strip projector. The lecturer thus is saved preparing lantern slides with their attendant drawbacks of weight and fragility. These

(*Concluded at foot of Col.* 2.)

charts and tables printed on film should not be confused with the instructional film strip proper, since no explanatory text has been embodied into the tables, and there is no intention that they should be regarded as a ready-made lecture. They will, however, be of assistance to anybody who has to explain details of the charts printed in the Report. Copies of the film strips of the Costing Report charts will be supplied by the Secretary at the price of 10s. each, and orders should be accompanied by a suitable remittance.

"Craftsmanship for Export" Exhibition

Continuing their policy of showing their workers how otherwise not very interesting components actually contribute to intricate assemblies which in turn help the national export, John Harper & Company, Limited, Willenhall, have staged another "Craftsmanship for Export" Exhibition. Their first exhibition, dealing with iron castings for typewriters, showed that 60 employees of this one firm made all the castings for the whole of the British typewriter industry, whose exports sold for nearly £400,000 in the export market last year.

Now a second exhibition in Harper's works deals with the products of the finishing section, the machine, tinning and polishing shops, which employ about 50 persons working on the articles shown. These workers, as shown by the exhibition, process such diverse articles as power-driven and hand-operated food mincing machines, castings for electrical equipment, refrigeration and radiology, shop scales and ships' deck light fittings, specimens of all of which are included in the exhibition.

The annual export value of these products, made by only a small section of the works, is approximately £45,000. Similar exhibitions will from time to time be staged for other sections of the Harper works.

Congres International des Fabrications Mecaniques

A brochure detailing the programme of Papers to be read at this Congress, to be held in Paris from September 13 to 18, and of the works' visits arranged in the Paris area is now available on application to the Publications Division, The British Engineers' Association, 32, Victoria Street, London, S.W.1.

The brochure also gives information as to the arrangements for ladies accompanying participants in the Congress and of three "Study-tours" arranged to the machine-tool factories at Chateaudun; to the Compagnie Fives-Lille; and to works at Graffenstaden, Belfort, Grenoble, and the Genissiat Power Plant. The last-mentioned tour provides for a visit to the French Machine Tool & Engineering Fair at Basle.

CONSEQUENT UPON the recently announced reduction in the price of linseed oil, some makers of core oils have stated their intention of passing this on to the consumers.

Gas Porosity in Nickel-Silver Castings*

Conditions required for successful melting

By T. F. Pearson, M.Sc., F.I.M., W. A. Baker, B.Sc., F.I.M., and F. C. Child, M.Sc., A.I.M.

Summary

Cast nickel silvers occasionally exhibit gross gas unsoundness and the cause of this defect has been studied by small-scale melting and casting experiments. It is shown that these alloys are not seriously subject to hydrogen gas unsoundness; in this respect they differ from most other non-ferrous metals, but are akin to the brasses.

Gross gas unsoundness can arise from the evolution of carbon monoxide during solidification. It appears that carbon and oxygen co-exist in solution in the molten alloys and, when present in the melt in critical proportions, they recombine during solidification with a resultant evolution of carbon monoxide. Melting under strongly oxidising conditions and/or deoxidation before pouring eliminate the gas unsoundness.

Introduction

It is well known in practice that nickel-silver casting alloys are liable to exhibit gross unsoundness and the literature on the subject contains several Papers describing practices designed to avoid this trouble. The recommended practices deal with such points as the order of charging when melting these alloys, control of melting atmosphere and deoxidation practice, and while there is no agreement on the first point, it appears to be agreed that melting in strongly oxidising conditions followed by deoxidation, in some cases with several deoxidants added in succession, yields satisfactory results.

Gas unsoundness is a problem both in the chill and sand-casting industries, for example, in the former, porosity in chill-cast ingots tends to cause spills and blisters in the rolled sheet, while in the latter case porosity in sand-cast plumbing ware, etc., causes leakage under pressure and introduces serious difficulties in finishing treatments, including electro-plating. A fuller understanding of the causes and means of controlling this porosity may be expected to lead to improvements in industrial practice. The experimental work about to be described was therefore carried out some time ago with a view to determining the cause of the gas unsoundness so that industrial melting practices could be put upon a sounder basis.

The work done established the cause of the unsoundness, but the outbreak of war prevented the logical continuation of the research, namely, a study of the equilibrium between carbon and oxygen dissolved in molten nickel silvers. Thus the present Paper does not give a quantitative account of the mechanism involved in the development of gas unsoundness in nickel-silvers, but the qualitative results serve to explain practical experience and for that reason appear worthy of record.

* Communication from the British Non-Ferrous Metals Research Association presented at the London (1948) Conference of the Institute of British Foundrymen held in June.

Scope of Work and Materials Used

An alloy containing 60 per cent. copper, 20 per cent. nickel and 20 per cent. zinc was selected as a typical alloy for the purpose of these experiments in the belief that the findings obtained with it would be applicable to nickel-silvers generally, notwithstanding the presence of appreciable proportions of lead in some of the sand-casting alloys and the considerable variation in nickel content of the industrially important alloys. Melts were prepared from high-purity commercial materials, namely, oxygen-free high conductivity copper, cathode copper or remelted and oxidised cathode copper, Mond nickel pellets or electrodeposited nickel, and electrolytic zinc. Typical analyses of these materials are shown in Table I.

TABLE I.—*Analysis of Materials.*

Element	Oxygen-free copper.	Remelted cathode copper.	Remelted zinc.	Mond nickel shot.	Cathode nickel.
Cu ..	99.98+	99.84+	0.0005	0.012(c)	0.017(c)
Ni ..	0.0003	0.0006	—	99.83+	99.66+
Zn ..	<0.001	N.D.	99.99+	N.D.	N.D.
C ..	—	—	—	0.107(c)	0.024(c)
S ..	—	<0.0005(c)	—	0.001(c)	0.0008(c)
O_2 ..	—	0.15(c)	—	—	—
Ag ..	0.003	<0.002	Trace	N.D.	N.D.
As ..	<0.002	N.D.	N.D.	N.D.	N.D.
Bi ..	0.0001	N.D.	N.D.	N.D.	N.D.
Cd ..	N.D.	N.D.	0.001	N.D.	N.D.
Co ..	<0.0001	N.D.	—	Trace	0.28(c)
Fe ..	0.002	<0.0002	0.002	0.037(c)	0.008(c)
Mg ..	N.D.	N.D.	N.D.	0.003	0.003
Mn ..	<0.005	N.D.	N.D.	<0.003	<0.003
P ..	N.D.	N.D.	N.D.	N.D.	N.D.
Pb ..	0.003	0.002	0.002	N.D.	N.D.
Sb ..	0.0005	N.D.	N.D.	N.D.	N.D.
Si ..	N.D.	Trace	N.D.	0.004(c)	0.005(c)
Sn ..	0.0005	N.D.	N.D.	N.D.	N.D.

N.D.—Not Detected.

The figures given above were obtained by spectrographic analysis except those marked (c) which are the results of chemical analysis.

High-frequency Furnace Melting in a Tube Furnace

(*a*) *Melting and Casting Technique*

These initial experiments employed the melting and casting technique described in an earlier Paper[1] on the

Gas Porosity in Nickel-Silver Castings

melting and casting of bronzes. The apparatus comprised a vertical silica tube containing a magnesia crucible supported above the mould by a silica sleeve. The bottom of the magnesia crucible had a pouring aperture of controlled size, stoppered by a closed end silica tube which extended vertically upwards through the head sealing the upper end of the main silica tube. The temperature of the melt was measured by focusing an optical pyrometer on to the interior of the silica stopper tube. Both the top and bottom ends of the main furnace tube were closed by gas-tight water-cooled heads so that chosen gas atmospheres could be maintained in the tube throughout the melting and casting operation. Casting was effected by lifting the stopper tube through its rubber gasket.

Charges weighing approximately 700 gms. were melted and cast in this way, and in a typical experiment the charge was heated quickly to the liquidus temperature (1,100° deg. C.) superheated in four to six minutes to 1,200 deg. C., held at that temperature for a period of ten minutes and then cast from the same temperature.

The castings so obtained were approximately 8 in. long, tapering from 1 in. dia. at the top to $\frac{1}{2}$ in. dia. at the bottom. These test castings were made in massive copper moulds and in dry-sand moulds. The latter were prepared from a coarse silica sand bonded with 5 per cent. of bentonite and dried for two hours at 250 deg. C. The chill mould was lightly coated with acetylene soot.

The bottom 5-in. length of the test-piece was cut off and its density measured before machining from it a standard tensile test-piece. From these determinations, the percentages of voids in the castings were calculated to an estimated accuracy of $\pm$ 0.1 per cent. Allowance was made for composition differences, the most important being variation in zinc content (usually between 18 and 20 per cent.). Variations in nickel content were comparatively small and in any case would have had little effect on the density, while, for the 60/20/20 alloy, variation of zinc content would produce linear changes in density of the order of 0.015 gms./cc. per 1 per cent. zinc (density of 60/20/20 alloy, 8.725 gms./cc.).

(*b*) *Experimental Results*

(i) *Shrinkage Effects* (castings made from oxygen-free copper, etc., in a nitrogen atmosphere).—In the experimental work on bronze castings using this technique,[1] preliminary experiments showed that shrinkage porosity was reduced to a minimum by pouring at the slowest possible speed compatible with a reasonably satisfactory surface on the casting. This refers particularly to chill castings where a slow pouring speed sets up steep temperature gradients in the casting in a vertical direction so that feeding of freezing shrinkage is greatly facilitated. However, whereas a 90/10 tin bronze with a freezing range of 200 deg. C. gave substantially sound chill castings of this form when cast in 16 to 18 secs. ($\frac{1}{8}$ in. dia.. pouring aperture), a 60/20/20 nickel-silver alloy with a freezing range of only 75 deg. C. yielded chill castings substantially free from porosity when cast in only 4 to 5 secs. ($\frac{3}{16}$ in. dia. pouring aperture) (see first two results in Table II). For the majority of the further experiments, therefore, a $\frac{3}{8}$ in. dia. pouring aperture was used. The sand castings, in which relatively flat temperature gradients occurred despite the use of slow pouring, were appreciably unsound, as can be seen from the typical result quoted in Table II.

TABLE II.—*Nickel Silvers Melted and Cast in Dry Nitrogen.* (*Casting Temperature*, 1,200 deg. *C.*)

Materials in the charge.	Dia. hole, in.*	Voids, per cent.†	U.T.S. tons per sq. in.	Elongation, per cent.
Oxygen-free Copper in Charge.				
Chill castings :—				
O.F.H.C. Cu, Mond pellet or cathode Ni	$\frac{1}{8}$	0.2	22.8	44
Electrolytic Zn ..	$\frac{1}{16}$	0.3	19.8	43 } Typical results.
Sand castings :—				
As above	$\frac{1}{16}$	0.9	11.5	20
Oxygen-bearing Copper in Charge.				
Chill castings :—				
(*a*) Cu, Mond pellet Ni	$\frac{1}{8}$ and $\frac{1}{16}$	1.3 to 4.3	Average of 5 melts, 2.6 per cent. voids, whole of Cu dissolved.	
(*b*) " "	$\frac{1}{16}$	0.0 to 2.4	Average of 3 melts, 1.2 per cent. voids, part of Cu undissolved.	
(*c*) Cu, decarburised Ni (0.002 per cent. C.)	$\frac{1}{16}$	0.2 to 0.3	2 melts. Part of Cu undissolved.	

* Pouring aperture in bottom of crucible.
† In bottom 5 in. length of test casting.
(*a*) Cu—part or whole of charge comprised of Cu containing 0.15 per cent. O.
(*b*) Cu—part or whole of charge comprised of Cu containing 0.93 per cent. O.

(ii) *The Effect of Carbon and Oxygen in the Components of the Charge.*—The melts prepared and cast in a nitrogen atmosphere, using oxygen-free copper and Mond nickel pellets or cathode nickel, consistently gave relatively sound castings which were considered to be substantially free from gas porosity. When the charge included oxygen-bearing copper, however, chill-cast test-bars showed widely varying degrees of unsoundness, the porosity appearing as spherical cavities, a typical example being illustrated in Fig. 1. In most of the experiments all the copper was dissolved and much of the oxygen remained behind as a light deposit of zinc oxide on the crucible walls. In a few cases, where the oxygen content of the copper was high, some of this copper remained undissolved and micro-sections showed that an adherent film of zinc oxide or other complex oxide had formed on the surface of the copper, preventing its solution in the melt, although the copper had undoubtedly been molten at some stage.

The degree of unsoundness in the castings bore no apparent relation to the oxygen and carbon contents of the charges, although the oxygen contents were varied between wide limits, ranging from a large excess to less than the amount required to combine with the carbon of the charge (as the monoxide). However, when the charge was comprised of decarburised nickel the castings obtained were substantially free from porosity

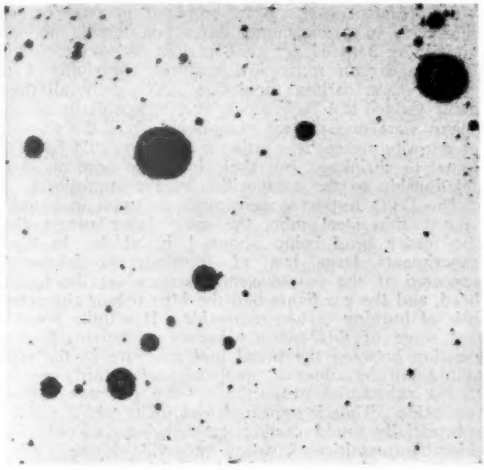


FIG. 1.—SPHERICAL CAVITIES IN AN UNSOUND NICKEL-SILVER CHILL CASTING. ×10.

although part of the copper again remained undissolved. The latter results were consistent and appeared to dispose of the possibility that the porosity in other castings was due to mould gas (nitrogen) injected by a pouring stream whose free flow was hindered by a pool of molten copper in the bottom of the crucible. The alternative explanation was that the porosity was due to a reaction between oxygen and carbon during freezing, with the liberation of carbon monoxide.

In an attempt to verify this possibility, further melts were prepared in a nitrogen atmosphere using charges made up from oxygen-free copper, electrolytic zinc, and either pellet nickel of relatively high carbon content or cathode nickel of relatively low carbon content. These melts were top-poured into a cylindrical steel mould 1½ in. internal diameter and 4½ in. deep which contained a copper plug (2 in. long and ¼ in. in diameter) projecting upwards from the base of the mould. These copper plugs were of varying oxygen content and in some cases oxygen-free plugs were used. The plugs were carefully cleaned with acid and acetone before insertion in the mould, and the whole assembly was warmed to about 50 deg. C. by radiant heat from the melting crucible whilst the charge melted.

The stream of metal from the casting crucible impinged on the copper plug and more or less dissolved it, and the castings so obtained were subsequently examined by density measurements and by sectioning. From the typical results given in Table III, it can be seen that castings made using pellet nickel, with no plug, or with oxygen-free plugs, contained only a small amount of porosity which could be attributed to shrinkage, while castings made with plugs with increasing oxygen content were unsound to a degree which increased with

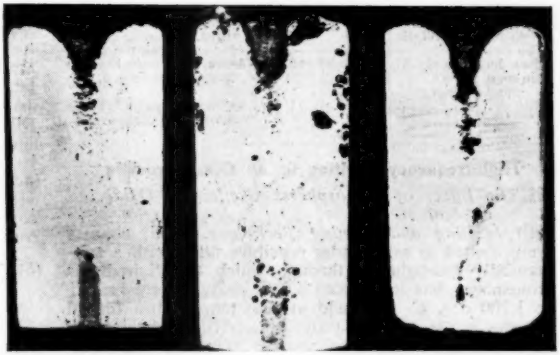
TABLE III.—*Nickel Silvers Melted and Cast in Nitrogen and Poured on to Copper Plugs of Varying Oxygen Content.*
Pouring temperature, 1,200 deg. C. ¼ in. dia. pouring aperture.

Materials in charge.	Voids, per cent.	Oxygen content of plug.
O.F.H.C. Cu, Mond—	0.6	No plug
Pellet Ni, electrolytic Zn	0.3	O.F.H.C. plug
	3.7	0.06
	6.1	0.15
	3.9	0.3
	9.5	0.47
	10.8	0.56
	7.8	0.89
As above but Cathode Ni	1.5	0.56
	0.9	0.54

the oxygen content of the plug. When cathode nickel of lower carbon content was used relatively little unsoundness occurred even when high-oxygen plugs were used. Typical sections through the castings are shown in Figs. 2 (*a*), (*b*) and (*c*).

These results support the view that porosity can arise as a result of reaction between carbon and oxygen during solidification, but the evidence so far presented throws no light on the mechanism involved.

(iii) *The Effect of Sulphur.*—To examine the possibility that sulphur might similarly be a source of unsoundness, melts were made from oxygen-free and oxygen-bearing copper and pellet or cathode nickel. Additions of copper sulphide were made to the charge before melting or after melting and just before pouring



(*a*) (*b*) (*c*)

FIG. 2.—SECTIONS THROUGH NICKEL-SILVER INGOTS POURED ON TO COPPER PLUGS (HALF SIZE).

(*a*) Oxygen-free plug; (*b*) 0.56 per cent. oxygen in plug and 0.02 per cent. carbon in melt charge; (*c*) 0.54 per cent oxygen in plug and 0.005 per cent. carbon in melt charge.

Gas Porosity in Nickel-Silver Castings

into chill moulds. All the castings obtained were substantially free from porosity and there was no evidence that sulphur promoted serious gas unsoundness.

(iv) *The Effect of Water Vapour or Hydrogen in the Furnace Atmosphere.*—In similar experiments the melting atmospheres used were mixtures of nitrogen and water vapour, the moisture content of the atmospheres varying from 2-10 per cent. (in these experiments the whole furnace tube and its contents were heated to about 120 deg. C. to avoid condensation). Also melts were prepared in atmospheres containing equal parts of nitrogen and hydrogen. Some average results of these experiments are shown in Table IV. It can be seen that the chill castings were substantially free from porosity, and while the sand castings made in atmospheres rich in hydrogen showed slightly more voids than those made in nitrogen atmospheres, the amount of unsoundness was still quite small. It was to be expected that these alloys would be substantially immune from hydrogen-gas unsoundness because, as with the brasses, their high zinc content exerts a relatively high vapour pressure and thus hydrogen would not be likely to dissolve in the melt from the atmosphere and any hydrogen in the materials initially charged would largely be expelled. The experimental results confirm this expectation.

TABLE IV.—*Nickel-Silvers Melted and Cast in Moist Nitrogen or Hydrogen-Nitrogen Atmospheres.*
Pouring temperature, 1,200 deg. C.

Materials in charge.	Dia. hole, in.	Voids, per cent.	Remarks.
Chill castings :			
O.F.H.C. Cu, Mond pellet Ni, electrolytic Zn	½	0.3	Average of 5 melts in nitrogen containing 2 to 9.6 per cent. water vapour.
Ditto, but cathode Ni in some melts	½	0.2	Average of 3 melts in 50/50 Nitrogen-Hydrogen.
Sand castings :			
Ditto	½	1.6	Average of 2 melts in 50/50 Nitrogen-Hydrogen.

High-frequency Melting in an Open Crucible

(a) The Effect of Atmospheres Containing Oxides of Carbon

(i) *Melting and Casting Technique.*—5-lb. charges were melted in salamander crucibles fitted with a substantially gas-tight lid through which the desired gas atmosphere was introduced. The charges were heated to 1,200 deg. C. and held at that temperature for 10 minutes in the controlled atmosphere before being cast into dry sand DTD-type test-bar moulds. Carbon monoxide and carbon monoxide/carbon dioxide mixtures were produced by passing carbon dioxide through a charcoal furnace held at suitable temperatures. Mixtures of nitrogen and carbon monoxide were obtained by passing suitable mixtures of dry nitrogen and air through the charcoal furnace held at 1,100-1,150 deg. C. All the mixtures were dried with silica-gel towers.

(ii) *Results.*—Melts were prepared in pure carbon monoxide, in carbon monoxide/carbon dioxide mixtures containing 3 to 47 per cent. carbon monoxide, and in nitrogen/carbon monoxide mixtures containing 4 to 50 per cent. carbon monoxide. Practically all these melts yielded test bars which were substantially sound. There were one or two exceptions where the amount of porosity present was rather more than could be attributed to shrinkage, but their incidence bore no clear relationship to the composition of the atmosphere.

The DTD test bars were made as usual in a well-vented thin steel tube, the sand layer surrounding the feeder head being about ¼ in. thick. In these experiments large jets of burning gas frequently appeared at the mould vents surrounding the feeder head, and the gas flame had the blue colour characteristic of burning carbon monoxide. It is quite possible that some of this gas was hydrogen, deriving from a reaction between the metal and moisture in the sand mould, but the colour of the flame made it fairly certain that a substantial proportion of the gas was carbon monoxide. Thus it appeared that melts which yielded substantially sound castings nevertheless evolved considerable quantities of carbon monoxide during cooling from the casting temperature but prior to solidification.

The behaviour can be explained on the lines of the theory advanced by Hultgren and Phragmen[2] for the equilibrium between carbon and oxygen in molten iron. To put the analogy briefly, if significant amounts of both carbon and oxygen are assumed to exist in solution in the molten nickel-silver (notwithstanding the presence of 20 per cent. of zinc) gas evolution will occur on cooling the liquid alloy if the value of the equilibrium constant (proportional to the product of the carbon and oxygen concentrations) decreases with temperature. Moreover, if the initial concentrations of carbon and oxygen in the melt are such that one reactant is largely eliminated by this gas evolution before the temperature falls appreciably below the liquidus, little further gas evolution will occur in the later stages of freezing, in which event the evolved gas may escape from the metal and no gas unsoundness will result. This explanation assumes that the carbon and oxygen contents giving rise to porosity in castings is very critical. In this respect it would explain the inconsistent results of earlier experiments where attempts were made to control the final carbon and oxygen concentrations by controlling their initial values in the components of the charge.

(b) The Effect of Oxidising and Carburising Treatments On Nickel-Silver Melts

The above line of thought suggested a series of experiments in which relatively large melts were:—(i) initially carburised and then progressively oxidised: or (ii) initially oxidised and then progressively carburised, small castings being poured at intervals in each case.

In a typical experiment a 15-lb. charge was melted in a salamander crucible in a high-frequency furnace under a deep layer of charcoal and, after holding at 1,200 deg. C. for various periods, small 2-in. diameter sand-cast blocks were poured. Later the charcoal

cover was removed and the melt oxidised by exposure to air, and again small castings were poured at intervals after exposure to the oxidising atmosphere. In other experiments the charge was melted in air, test castings were poured, and the charge was then carburised by the addition of small quantities of nickel with a high carbon content in addition to a charcoal cover. Again small test castings were poured at intervals after these carburising additions. The densities of the castings were measured and the percentages of voids in the castings were calculated. Table V contains the details of two such typical experiments from which it can be seen that castings poured from highly carburised or highly oxidised melts were substantially sound, but that between these two extremes, castings with varied and in some cases very large amounts of gas porosity were obtained.

TABLE V.—*The Effect of Oxidising and Carburising of Nickel-Silver Melts.* Pouring temperature, 1,200 deg. C. Sand cast blocks 2 in. dia., 2 in. high

Treatment of melt.	Per cent. voids.
15 lb. charge, cathode Cu, Mond pellet Ni, electrolytic Zn	
Melted and held under C 15 minutes	9.0
Further 10 minutes under C	4.3
2 minutes after removal of C cover	6.0
5 minutes after removal of C cover	6.7
7 minutes after removal of C cover	14.4
15 lb. scrap melted and held in air for 10 minutes ..	3.8
1 min. after addition of C cover and 0.014 per cent. C. (as Ni containing 1.6 per cent. C.)	5.3
2 minutes ,, ,, ,, ,, ..	12.0
5 minutes ,, ,, ,, ,, ..	22.8
10 minutes ,, ,, ,, ,, ..	4.4

The high-frequency furnace melting capacity available for such experiments did not allow a single melt to be taken through a complete cycle, *i.e.*, oxidised/carburised/oxidised, and accordingly a number of melts were made in each of which a part of the cycle only was examined. The experimental results for the whole series of tests are plotted in Fig. 3, where the condition of the melt, *i.e.*, carburiscd, intermediate, or oxidised, is represented by the time intervals at which castings were poured. The percentages of voids in the castings are plotted on the other axis and are related in this way to the condition of the melt. There is a considerable scatter in the experimental results, presumably because the times required to produce given carbon/oxygen concentrations were not consistent from one melt to the next. Nevertheless the results indicate that there is a critical concentration of carbon and oxygen in solution in the melt which gives rise to gross unsoundness in the castings.

A notable feature of these experiments was that "fully carburised" melts evolved large quantities of gas at a temperature just above the liquidus, the gas bubbles often raising a thin skin of oxide to form a large blister on the top of the block casting. In many cases the gas evolution occurred so close to the liquidus temperature that large smooth-walled blowholes were formed and these extended deep into the block, and were only exposed when the covering oxide skin was broken. This observation confirmed that already recorded and supported the view that one of the reacting constituents (in this case oxygen) may be eliminated by gas evolution before the casting freezes.

Melts in Gas-fired Furnaces

(a) Effect of Oxidising and Reducing Atmospheres

5-lb. charges of the 60/20/20 alloy were prepared from cathode copper, pellet or electrolytic nickel and electrolytic zinc. The charges were melted in a Salamander crucible in a gas-fired furnace whose atmosphere was readily made strongly oxidising or strongly reducing, as required. Various methods of charging the crucible were examined in view of the importance attached to this point in literature on the subject and in view of the observation in the present work that pieces of oxygen-bearing copper might become coated with a refractory oxide layer.

Thus in some cases the copper was melted alone in clean crucibles under a deep layer of charcoal and under strongly reducing conditions; these melting conditions yielded molten copper with a very low oxygen content (*e.g.*, less than 0.001 per cent.). The zinc was then added and was followed by the nickel pellets. In other experiments the copper and the nickel were melted together under a strongly reducing flame with or without a carbon cover, and the zinc was added last. None of the melts was deoxidised. These variations had no significant effect on the soundness of the sand-cast test bars, but the castings obtained were generally unsound, although the degree of unsoundness was most

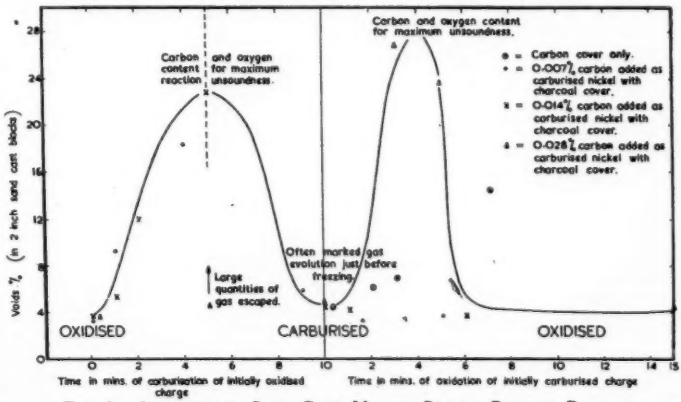

Carbon and oxygen content for maximum unsoundness.
Carbon content reaction
and oxygen for maximum unsoundness.
Carbon and oxygen content for maximum unsoundness.
● = Carbon cover only.
• = 0·007% carbon added as carburised nickel with charcoal cover.
x = 0·014% carbon added as carburised nickel with charcoal cover.
▲ = 0·028% carbon added as carburised nickel with charcoal cover.
Often marked gas evolution just before freezing.
Large quantities of gas escaped.
OXIDISED
CARBURISED
OXIDISED
Voids % (in 2 inch sand cast blocks)
Time in mins. of carburisation of initially oxidised charge
Time in mins. of oxidation of initially carburised charge

FIG. 3.—POROSITY IN SAND CAST NICKEL-SILVER BLOCKS PLOTTED AGAINST TIME OF OXIDATION OR CARBURISATION OF THE MELT.

Gas Porosity in Nickel-Silver Castings

erratic. Thus, sand cast test bars of the DTD type yielded specimens containing 0.7 to 5 per cent. voids in the bar portion of the casting and 4 to 15 per cent. voids in the feeder head.* An illustration of the gross gas unsoundness sometimes encountered is shown in Fig. 4.

On the other hand, charges melted in a strongly oxidising gas flame consistently yielded sound castings irrespective of the order of charging the constituent metals and whether or not the metal was finally deoxidised (with small successive additions of manganese and magnesium). For example, sand-cast DTD test bars averaged 0.7 per cent. voids in the bar portion and 4 per cent. voids in the head, which amounts of porosity were considered to be due to shrinkage. Fig. 5 illustrates the shrinkage cavity in the head of a typical sound test bar. The 4 per cent. voids in such heads represent the smaller dispersed cavities disposed round the main cavity.

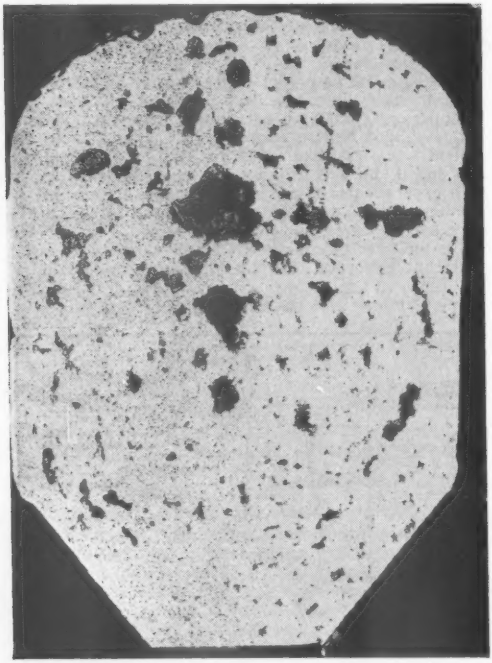


FIG. 4.—GROSS GAS POROSITY IN THE HEAD OF A SAND-CAST (D.T.D.) TEST BAR (FULL SIZE)

* Feeder heads were cut longitudinally into two pieces to expose major shrinkage cavities before density measurements were made.

(*b*) *The Effect of Deoxidation*

As already mentioned, the literature advocates deoxidation with two or three elements added in succession and a few tests were made to determine whether such a treatment was really necessary. Charges were melted in a gas furnace under strongly reducing conditions and small blocks 2 in. diameter and 2 in. deep were sand-cast before and after separate additions of manganese (0.025 per cent.), or magnesium (0.02 per cent.), or phosphorus (0.02 per cent.). In each case, the specimens cast without deoxidation were grossly unsound, containing 7 to 9 per cent. voids, while those cast after deoxidation were consistently sounder, the voids varying between the limits 3.5 to 3.8 per cent. It cannot be said with certainty that the whole of this latter porosity was due to shrinkage, but it seems likely that each of these three deoxidants alone is capable of suppressing the gas unsoundness.

(*c*) *The Identity of the Gas Causing Unsoundness*

The gross unsoundness in sand castings from melts made under reducing conditions has already been described and illustrated (Fig. 4). Samples of gas were extracted from the castings as follows:—Sand castings were prepared from melts made under strongly reducing conditions and specimens which were obviously most unsound, as evidenced by the rise of the head of the casting during solidification, were quenched into water as soon as possible after freezing, *i.e.*, when the temperature of the casting had apparently fallen to about 800 deg. C. The heads of the quenched castings were mounted without delay in a tank of water and covered with a submerged glass cowl. The porous heads were drilled with a large drill while mounted in this way, and the liberated gas was collected under the cowl and transferred to a gas analysis apparatus.

In some experiments hot water was used and in others cold water. In all cases the water was boiled before use. The analytical results from three such tests are shown in Table VI, from which it can be seen that hydrogen was virtually absent, the mixture comprising nitrogen, oxygen and carbon monoxide and (where hot water was used), some carbon dioxide. It can be seen that the oxygen/nitrogen ratio was lower than that for air and it is thought that some air was drawn into the cavities in the unsound castings while

TABLE VI.—*Composition of Gases Extracted from Grossly Unsound Sand Cast Nickel Silvers.*

Composition, per cent.*					Remarks.
O_2.	H_2.	CO_2.	CO.	N_2.†	
4.1	Nil	Nil	11.3	84.6	Cold water.
8.1	0.2	5.9	9.0	76.8	Hot water (40 deg. C.).
6.5	Nil	Nil	7.3	86.2	Cold water.

* Hydrocarbons were not detected.
† Nitrogen by difference.

they cooled to the quenching temperature and that some of the oxygen reacted with carbon monoxide in the cavities to form carbon dioxide and some of it combined with the hot metal surfaces. The carbon dioxide was presumably lost by solution in the water, when extracting under cold water, but some was detected when extracting over hot water. This method of gas extraction was very crude, but it had the merit that the results were not obscured by possible reactions which might occur in hot vacuum extraction.

The presence of oxides of carbon in the gases extracted from these unsound castings is regarded as direct proof that the gas unsoundness arose from the evolution of carbon monoxide during solidification.

Conclusions and Practical Recommendations

The laboratory experiments are consistent with practical experience in showing that nickel silvers yield consistently sound castings when melted under strongly oxidising conditions. Conversely melting under reducing conditions is liable to result in gas-unsoundness, although in this case results are erratic. Deoxidation with managanese, phosphorus or magnesium suppresses the gas-unsoundness, even if the melting conditions are unfavourable. The laboratory experiments also show that the nickel silvers are not seriously subject to hydrogen gas-unsoundness; in this respect they are akin to the brasses but different from most other non-ferrous casting alloys.

The gas-unsoundness observed is attributed to the evolution of carbon monoxide during solidification, and the evidence indicates that carbon and oxygen dissolve in the melt, giving rise to gas porosity only when their concentrations are at some critical value. The actual concentrations are not known, but it is reasonable to suppose that the oxygen content at least is very small, in view of the presence in the alloys of 20 per cent. or more of zinc. Bearing this point in mind, it is to be expected that powerful deoxidants will be required to reduce the oxygen content below its critical value, and this may explain the fact that some investigators advocate multiple deoxidation, and include magnesium among the deoxidants.

It is recommended that nickel-silvers be melted under strongly oxidising conditions, *e.g.*, by exposing the molten alloy to air, or by suitably controlling the fuel-air ratio, or by the inclusion in the furnace charge of oxidants, such as manganese ore, etc. Charcoal covers should not be used under any circumstances. Given strongly oxidising melting conditions, deoxidation is not essential, but it is nevertheless recommended as a safety measure.

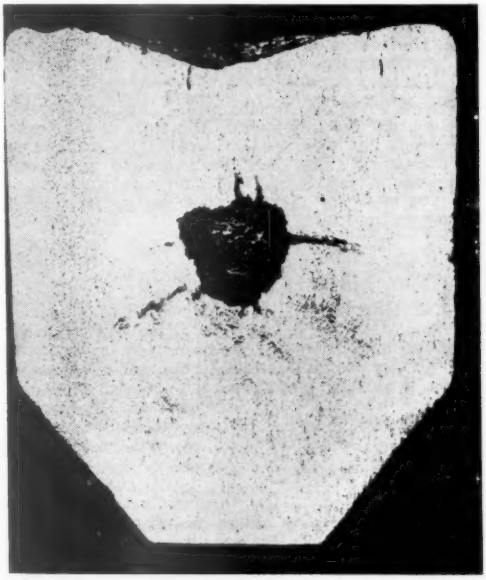


FIG. 5.—SOUND HEAD OF SAND CAST (D.T.D.) TEST BAR SHOWING SHRINKAGE CAVITY (FULL SIZE).

Acknowledgments

The Authors are indebted to the Director and Council of the British Non-Ferrous Metals Research Association for permission to publish this Paper.

DISCUSSION

MR. W. G. MOCHRIE commented upon the long time which had elapsed between the preparation of the Paper and its publication. Nevertheless, it was worthy of commendation and warranted inclusion in the large number of Papers in a series which was being digested throughout the world on the subject of gas unsoundness. The Author's references made at the recent Convention at Philadelphia on the subject was noteworthy, and the Paper gave a lead to the Americans in that connection.

The speaker said that his company had experienced many difficulties concerning nickel-silver alloys and had spent much time in seeking remedies. Unfortunately, those conducting the experiments were not able to recognise the gases located in the castings, and "hit and miss" methods were used to seek solutions. They were then led to examination of the raw materials for carbon content and oxygen, but that too had not provided a solution. They were handicapped in their efforts to determine the constituents of the materials through the lack of suitable analytical methods and often fractured ingot metal to search for gas pockets. Metals were then charged into a crucible, kept in an oxidising atmosphere and poured, with careful temperature control, into suitable moulds. Finally, as they could not recognise the gases which were present, it was decided that, rather than take the gases out of the metals in the first place, it would be more advantageous to direct the gases from the body of the casting to the risers by directional solidfication.

Gas Porosity in Nickel Silver Castings

MR. W. A. BAKER, replying on the question of the delay in presenting the Paper, said that it had been made available to members of the British Non-Ferrous Metals Research Association many years ago. Concerning Mr. Mochrie's last point, he was surprised that in the case of the alloys described, the gas tended to diffuse into the feeder head; one would not have expected that to happen in such a case because the elements involved were carbon and oxygen. He did not know what their speeds of diffusion were, but he would be surprised if they were sufficiently rapid to collect in the feeder head.

In those alloys which contained about 20 per cent. zinc, one would expect that the oxygen concentration would be continually buffered to a low value as the alloy solidified, so that the oxygen concentration would not rise appreciably, while the carbon concentration would rise in the residual liquid until carbon monoxide was evolved.

MR. F. HUDSON referred to the alloy containing roughly 20 per cent. nickel and 20 per cent. zinc which had been selected as the basis of the tests mentioned in the Paper, and said that that alloy was not widely used in this country to-day for the production of sand castings. The majority of producers of nickel-silver castings which had to resist pressure had recently adopted the American practice of using alloys of very low zinc content, approximately 2 to 4 per cent., or even 5 per cent. with lead, and the normal alloy in use at the present time for the production of such castings was roughly 5 tin, 5 zinc, 5 lead plus 20 per cent. nickel. When this alloy with a low zinc content was used, then, in addition to the reactions which Mr. Baker had mentioned between carbon and oxygen, there was also a tendency towards hydrogen absorption.

It should be appreciated that when an alloy differed considerably from the composition of that used as the basis for the tests referred to in the Paper, there was a possibility that hydrogen pick-up might also occur during melting.

MR. BAKER agreed with Mr. Hudson's comments. If an alloy differed to the extent he had described, and had a content of only 5 per cent. zinc, one should consider hydrogen gas unsoundness.

MR. A. TIPPER asked Mr. Baker, in connection with the type of alloy described by Mr. Hudson, if he would advocate an oxidising treatment as a panacea for gas unsoundness or the use of a scavenging flux.

MR. BAKER said that for an alloy of the type mentioned by Mr. Hudson (containing 2 to 4 per cent. zinc), the best remedy would be to melt under oxidising conditions and eventually to scavenge. There was a variety of methods of scavenging, though they might not all be appropriate in the case mentioned by Mr. Tipper. The method employing carbon dioxide would be appropriate in this case.

REFERENCES

[1]T. F. Pearson and W. A. Baker. Journal Inst. Met., 1941, **67**, 231.

[2]A. Hultgren and G. A. Phragmen. Trans. A.I.M.E., 1939, **135**, 133.

House Organs

The Nickel Bulletin for June

The main article in this issue touches on the full range of non-ferrous castings, in which nickel plays an important part. The Bulletin also includes useful data on the approximate relationships between the various hardness numerals obtained from nickel and high nickel alloys, in addition to numerous abstracts under the headings of electrodeposition, nickel-iron alloys, cast irons, constructional steels, and heat- and corrosion-resisting alloys. The Nickel Bulletin is obtainable free of charge from the Mond Nickel Company, Limited, Grosvenor House, Park Lane, London, W.1.

G.E.C. Journal, Vol. XV, No. 2, July, 1948. Published by the General Electric Company, Limited, Magnet House, Kingsway, London, W.C.2. Price 1s.

The first article in this issue is "Gas Carburising," by D. M. Dovery and I. Jenkins. This is of particular interest, as one of the Authors has done so much in the field of decarburising of cast iron by gaseous reaction for the rapid production of malleable iron castings. The reviewer is sure that a study of this article will interest those of our readers who have had experience of decarburisation.

Steel Horizons, Vol. 10, No. 3. Published by the Allegheny Ludlum Steel Corporation, Pittsburg, Pa., U.S.A.

Few, if any, house organs make better use of colour printing than Steel Horizons. This issue covers kitchen ware, nuts and bolts, outdoor cooking, the manufacture of pop-corn vending machines, glass to metal seals, and camera tripods, all, of course, carried out in stainless steel, for the object of this magazine is to popularise that alloy.

Forty Years Ago

"The Foundry Trade Journal and Patternmaker" for August, 1908, reported the issue by the Home Office of Regulations for the casting of brass. There were articles on the Deutz Gas Engine Works Foundry; on the pyrometric installation at Woolwich by Wesley Lambert—who was later to be president of the Institute of British Foundrymen, and the Baillot regenerative cupola. Robert Hadfield received the honour of knighthood.

BEFORE the opening of the Autumn Session at the Borough Polytechnic, London, it is necessary to fill the vacancy of a part-time day lecturer in foundry practice. If London foundries can release a suitable man or if qualified individuals can spare the time, will they please write to the Principal, Borough Polytechnic, London, S.E.

Use of Synthetic Sand for Cast Magnets

By R. S. Turner

The author was responsible for the manufacture of large quantities of small cast permanent magnets in the usual range of magnet steels and decided to find out if any improvement could be obtained with the use of different facing sands. This is the report on the experiments carried out, the objects of which were: (1) To reduce the cost of facing sand; (2) to obtain a smoother finish on castings already in production; and (3) to find a sand suitable for some very small magnets which had to fit gauges in the as-cast condition, as this could not be done with the existing methods.

Original Methods

Most of the magnets were either made on moulding machines and cast green, or made in dry-sand cake cores and assembled as stack or tier-moulds. The facing sand mix for the moulding machines had been in use for some years and the results were fairly good but there was still some room for improvement in the surface finish. This sand was mainly Chelford silica sand with small additions of Yorkshire yellow and Mansfield red and 4 per cent. of semi-solid core compound. The permeability was quite satisfactory but the green strength was high, which, though suitable for obtaining a good "lift," reduced flowability and sometimes caused rough surfaces by being too "tough" to be squeezed completely round the patterns. The sand used for the dry-sand cake-cores consisted of fine silica sand with additions of oil and cereal binders and no refractory paint was used on these cores as it was not practicable to apply it. The object of this system of moulding is to improve the yield ratio of castings to runners, also to reduce labour costs, and it certainly does this, but the saving is often more than offset by additional fettling costs caused by rough surfaces and the extra flash usually associated with dry-sand moulding.

The position was that the quality of the castings made on moulding machines was better than that of the castings made in stack moulds and in many cases the labour costs were lower when fettling was included but another factor had to be considered, namely, the cost of the facing sand. This had become a very important item due to the high cost of linseed oil and its effect on the price of semi-solid core compounds. Investigations revealed that the facing sand cost over 5s. per cwt. and that 1 cwt. of this sand was used in making 4 moulds. It will be appreciated that this had a very marked effect on the ultimate cost of the castings and that efforts had to be made to find a cheaper sand. Moreover, orders had been received for large numbers of very small magnets upon which the surface had to be particularly good so that they would fit a gauge with a tolerance of only 0.010 in., and neither of the sands in use would give this degree of finish.

The reason why the green sand moulds gave a better finish than the dry-sand cake-cores was then considered and it was decided that the oil in the green-sand had a similar effect to that of the coal dust used for grey iron, in that it formed a gas film on the surface of the mould, thereby preventing the metal taking the shape of the individual sand grains on the face of the mould. Therefore the properties being obtained from the semi-solid core compound were the bond and the creation of a slight gas pressure on contact with the molten metal.

Developing a Synthetic Mix

These properties could be obtained at a much less cost by using a clay bond and coal dust, and it was decided to make some experiments on these lines to see if any ill-effects developed in other ways, at the same time varying the strength so that the most suitable sand could be found for the small magnets required to very close limits. For close control and to obtain the necessary refractoriness a synthetic sand was used consisting of a fine washed silica sand with additions of bentonite, coal dust and cereal (starch). The sand was dried before mixing and a predetermined amount of water added. The first mix to be used is given below, together with the cost of the materials.

336 lb. fine silica sand at £1 5s. ton ...	45d.
12 lb. bentonite at £24 ton	31d.
6 lb. coal dust at £6 12s. ton	4d.
2 lb. cereal (starch) at £56 ton	12d.
5 quarts of water	—
	92d.
Approximate price per cwt. ...	2s. 4d.

The cereal is added to prevent the risk of edges crumbling, which sometimes occurs when using synthetic sands, due to quick drying out. The green strength was fairly high but this was necessary as most of the magnets were made on straight-draw machines without stripping plates. Results from the use of this sand were very encouraging, but it was thought that the surface could be further improved, so another mix was made using 7½ lb. of coal dust instead of 6 lb., which slightly increased the cost. Samples of various magnets were cast using this modified facing sand and sent for machining, and the finished magnets were satisfactory in all respects.

These experiments have shown that satisfactory magnets can be made using a clay bonded sand costing less than half the price of an oil-bonded sand, and that in many cases the surface finish is better. It is possible that further economies may be made as experience is gained with this type of sand.

Sand for Small Magnets

The next problem was to find a suitable sand for the small magnets. It was realised that to get the required finish, a sand with a good flowability was essential and to obtain this the sand would necessarily have a low green strength. The design of this magnet was such that a high green strength facing sand would have been necessary if it were to be cast from an ordinary pattern on the straight-draw machines, so a stripping plate was made. This made it possible to

Synthetic Sand for Cast Magnets

use a low-green-strength facing sand, also, as a minimum of taper was called for, the stripping plate allowed the use of parallel-sided patterns. The magnet was ring-shaped and with a good "lift" assured by the use of the stripping plate, experiments were made to evolve a sand that was just strong enough to prevent the pieces of sand forming the holes in the castings from breaking off as the mould was turned over. The following mix was eventually decided upon: 336 lb. fine silica sand, 8 lb. bentonite, 6 lb. coal dust, 2 lb. starch cereal, and 3½ quarts of water.

An important point with this mixing was milling time which was set at 2½ minutes from when the water was added. A longer milling gave a reduced flowability, causing the surfaces of the castings to be rough. Methods of running are outside the scope of this article but it is necessary to mention that points such as the "number of jolts" and "depth of squeeze frame" must be closely controlled if the very close limits are to be consistently obtained. Large numbers of these castings have been made successfully using this facing sand, the cost of which is about 2s. 1d. per cwt.

It may be thought that further economies could be made by using naturally-bonded sand instead of the synthetic sand for both of the mixes described. In the Author's opinion, however, the close control that can be kept on synthetic sand mixes justifies the slightly higher cost, particularly when making steel castings to very fine limits. The control is closer on the synthetic sand than on the original oil-bonded sand as this contained proportions of naturally-bonded sands in which the moisture and clay content varied, so the change to synthetic-clay bonded sand has given a more reliable facing sand at less than half of the cost.

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high durability, high chalk resistance, and high fading resistance, and will be the nearest approach to a "universal" pigment yet made.

Several factors combined to make the Grimsby site attractive to the company, one of the most important being that there is a good supply of water available. At present three boreholes are in operation, each capable of delivering 40,000 gallons per hour. The site is well placed for the imports of raw materials and conveniently close to deposits of chalk and limestone which will be needed for the eventual manufacture of rutile titanium pigments extended with calcium sulphate. In addition, it is virtually at the mouth of the Humber, so that to all intents and purposes the effluent is discharged into the North Sea, and there is the additional advantage that the Humber water carries a considerable amount of solids in suspension, including a fair proportion of chalk, so that it is an efficient neutralising element for the effluent.

The design and construction of the whole plant was accomplished by the company's own staff under the direction of Mr. F. Carter, chief engineer.

We great appreciate the courtesy of the chairman and directors of the company in allowing our representative to see the development of this interesting new plant.

Production of Titanium Oxide Pigments

A new factory on the outskirts of Grimsby is rapidly being completed by British Titan Products Company, Limited, for the production of "Kronos" titanium pigments.

British Titan Products Company, Limited, is a private company, formed in 1933 to undertake the manufacture of, what was then a new white pigment, titanium oxide. This pigment was first made in commercial quantities in 1920 in Norway and America, and subsequently, in 1929, its manufacture was started in Germany. Work commenced on the building of the Billingham factory, on a seven-acre site, in July, 1933, and it was completed and in operation by July, 1934, at a cost of £240,000. Originally planned for a production of 2,000 tons of titanium oxide per annum, the output of the Billingham plant has since increased six-fold, and the site is now considered to be saturated.

The foundation stones of the new factory were laid on the 55-acre site at Grimsby on May 29, 1946. It was realised early in the war that considerably extended production capacity would be required immediately the war finished, and the search for a second site was carried out as and when opportunity occurred during the early part of the war. In 1943 the decision was taken by the company to erect another titanium oxide plant as early as possible, and shortly after that, Grimsby was decided upon as the most desirable location. The Grimsby factory is planned to be completed before the end of this year, and production from it is expected to be available very early in 1949.

The Grimsby plant, built at a cost of £1,250,000, is arranged for a production of 10,000 tons per annum of the latest rutile type titanium oxide pigments. There is to-day a growing demand for such pigments in the vitreous enamelling industry. Some 26 acres out of the total 55 acres available have been occupied, so that there is ample space for further expansion at a later date. Whereas at Billingham sulphuric acid and services are purchased from the neighbouring factory of Imperial Chemical Industries, Limited, Grimsby will be completely self-supporting, apart from the use of "grid" power, and to this end a 110 ton per day sulphur burning contact sulphuric acid plant is being erected alongside the titanium plant. This is claimed to be larger than any single contact unit operating in this country.

The new plant will manufacture 10,000 tons per annum of the latest type of rutile titanium oxide. Laboratory research work on a process for the manufacture of rutile type titanium pigments was started by British Titanium Products in 1938, but its translation to full-scale plant operation had to be postponed during the war years. Nevertheless, research work proceeded, although at a slower rate through the diversion of some of the scientific staff to work on atomic energy, and a process for manufacture was perfected which will be used at Grimsby. The product, which will be known as Rutiox CR, will combine high strength, good colour, high brightness, high dispersion,

(*Concluded in Col.* 1)

London Conference Discussion

Application of the Brinell Test in the Foundry*

Introducing the Author of this Paper (M. J. Léonard), the chairman, Dr. A. B. Everest, said he was sure they would all wish to welcome him to London.

(The Paper was then presented to the conference in abstract form by Mr. V. Delport acting for M. Léonard).

Opening the discussion, the chairman, DR. EVEREST, said the question of the relationship between tests on test bars and tests on actual castings was a very old one, and had received the constant attention of technical committees all over the world. He had had the pleasure of talking with M. Léonard in Brussels only a few weeks ago, and he realised that agreement on this subject was difficult. The British point of view was that tests on test pieces offered a useful check on the metal but no claim was made that they were a proper check on any particular casting. If, however, castings were properly made, then the test bar tests could be considered as sufficient. Their experience during the war was that with some important castings it was necessary to carry out tests on the castings themselves, but they had to get agreement between the manufacturer, designer and all concerned as to where the tests should be taken and what form they should be in, before it was considered that such tests really meant anything. There was no doubt whatever, as M. Léonard had pointed out, that the hardness test could give a useful indication of properties, and a survey all over the casting could relatively easily be made. A wide variation of hardness was found according to the different section and position of the test. His feeling was that this served to emphasise the point that no simple test could be devised even on the casting which would tell just how it would behave in service. In this country the tendency had been to concentrate on tests on a separately-cast test piece to evaluate the metal, and only rarely was it considered necessary to make tests on the actual castings, or on representative castings taken from a batch. In Belgium they were very much in favour of small test pieces cut from castings, and he understood M. Léonard supported that view. Such tests had well known disadvantages and were not favoured in this country.

MR. P. A. RUSSELL, B.Sc., wrote that he was pleased that M. Léonard had drawn attention to the Brinell testing method of exploring the strength of castings in various positions and sectional thicknesses, and he personally much preferred this method to the use of small test pieces tested either in tensile or shear, provided that the full 3,000 k.g. load were applied to the 10 mm. ball in a properly constructed Brinell machine. If Brinell hardness readings were taken on separately-cast test bars and on sectioned castings it should be possible to relate fairly accurately the results of the

(*Concluded at the foot of column* 2.)

* The official exchange Paper from the *Association Technique de Fonderie de Belgique* presented at the London Conference of the Institute of British Foundrymen and printed in the JOURNAL, July 1.

tensile test with the castings, provided the latter were free from internal stresses.

DR. EVEREST, closing the meeting, said if there were any other questions or comments he hoped they would be submitted in writing. They would then be submitted to M. Léonard.

He thanked M. Léonard sincerely for his Paper, and expressed the pleasure of the meeting in having him with them.

Book Reviews

The Old Door Knockers of Norwich, by Claude J. W. Messent, A.R.I.B.A. Published by Fletcher & Son, Limited, Castle Works, Norwich. Price 4s. 4d., post free.

The author has described and illustrated from his own sketches forty-five examples of mostly antique door knockers, which embellish houses in the city of Norwich. Some illustrate the craft of the moulder and others that of the smith. Some are grotesque, others of real classic beauty, and especially pleasing are those carried out in the Adams style. The oldest dates back 500 years, whilst the most recent, the sanctuary knocker at the catholic church of St. John the Baptist, has been included, as it is a revival of mediæval craftsmanship. The reviewer deems the book to be of real charm and absorbing interest, and worth emulation (by those capable of sketching) in other parts of the country. By so doing a national catalogue could be assembled of a decaying craft.

The Musgrave Pocket Book (5th Edition). Compiled and calculated by Musgrave & Company, Limited, St. Ann's Works, Belfast. Price 11s., post free.

One can test the utility of a pocket data book by relating the tables constantly being used with the total amount printed, yet this scarcely holds good, if only on rare occasions one is saved much trouble by the finding of a conversion factor or table. In this 120-page book the reviewer noticed quite a few factors not easily found in other data books. For the sheet metal worker, the machine shop foreman or the like, this booklet should be of the greatest use, whilst for the engineer who has to design plant for the handling of materials unfamiliar to him, real help will be forthcoming. The booklet is just on the big size for carrying comfortably in the pocket, but this is usual nowadays!

Statistical Year Book for 1946. Part II—Overseas Countries. Published by the British Iron and Steel Federation, Steel House, Tothill Street, London, S.W.1. Price 15s.

This is the first post-war issue, and commendable completeness has been achieved up to 1935. Only one country, the U.S.S.R., has failed to supply figures, and estimates have had to be made from "percentages of a given year for which no tonnage figures are available." No fewer than thirty-one countries are included, and these are supplemented by world tables. The book now runs to 329 pages. The British Commonwealth of Nations is shown to be the second largest producer of steel in the world in 1946, the U.S.A. being easily the leader.

New Patents

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patent)." Printed copies of the full Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The numbers given are those under which the Specifications will be printed, and all subsequent proceedings will be taken.

598,980 DAUSSON, H. J. Device for improving solidification of the head of ingots of effervescent steel.

599,180 YORKSHIRE COPPER WORKS, LIMITED, and CONE, J. R. Draw benches for bars, rods, tubes, etc.

599,188 BRITISH ALUMINIUM COMPANY, LIMITED, and PULLEN, A. N. D. Electrolytic treatment of aluminium.

599,210 CLAIRMONTE, E. B., and CLAIRMONTE, C. M. Tube joints.

600,015 STEVENS, A. H. (Great Lakes Steel Corporation). Low-alloy steels.

600,034 REYNOLDS METALS COMPANY. Electrolytic production of aluminium.

600,043 SOC. ANON. DES HAUTS-FOURNEAUX & FONDERIES DE PONT-A-MOUSSON. Apparatus for making metal pipes of small diameter by centrifugal casting.

600,066 SCHWARZKOPF, P., and OLLIER, J. O. Method of producing hard metal composition.

600,068 ELECTRO METALLURGICAL COMPANY. Iron-base alloys.

600,093 JESSOP & SONS, LIMITED, W., and LAWRENCE, P. H. Manufacture of moulds for casting metals.

600,095 MUNDT, T. W. Rail chairs.

600,138 LOGAN, W. A. Mining machines of the chain cutter type.

600,155 SCHORI METALLISING PROCESS, LIMITED, and LUMB, C. F. Method for coating surfaces.

600,210 GLACIER METAL COMPANY, LIMITED, and LIDDIARD, P. D. Control of moisture content in sands used for moulding.

600,436 ENGLISH ELECTRIC COMPANY, LIMITED, and BARLOW, K. F. Electric billet heating machines.

600,438 ENGLISH ELECTRIC COMPANY, LIMITED, and BARLOW, K. F. Electric billet heating machines.

600,467 STANDARD TELEPHONES & CABLES, LIMITED, Electrical apparatus for testing metals.

601,054 KELLOGG COMPANY, M. W. Apparatus for making cast-metal bodies.

601,057 WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY. Method of consolidating metal powder to dense coherent form.

601,073 ALLMANNA SVENSKA ELEKTRISKA AKTIEBOLAGET. Method of, and apparatus for, stirring the molten contents of metallurgical furnaces.

601,098 LANGANGRE, H. Moulding of metals under pressure.

601,113 LUX, E. Aluminothermic processes for the production of manganese and ferro-manganese from manganese ore.

601,214 NEHER, LIMITED, R. V. Method and apparatus for automatically controlling the thickness of metal strips, especially metal foils, in rolling mills.

601,225 MONTGOMERY, H. A. Method of preparing ferrous metals for cold drawing and to method of cold drawing.

601,250 PENICUD, J. W. Casting of non-ferrous metals.

601,260 AUSTENAL LABORATORIES, INC. Moulds for casting metals.

601,271 BRITISH THOMSON-HOUSTON COMPANY, LIMITED. Dies for coating wire.

601,324 FOSTER, H. E. Casting of metal bars, rods, sheets, and like.

601,468 MILLS, LIMITED, EXECUTORS OF J., and MACBETH, A. Machines or apparatus for straightening metal rods, bars and the like.

601,553 NEWTON, E. P. (Butler Bros.). Electrodeposition of iron.

601,588 PURNELL, C. G. Heat-treatment of hardenable steel.

601,590 STEVENS, A. H. (Byers Company, A. M.). Manufacture of wrought iron.

601,591 ONEIDA, LIMITED. Method of protecting metals and their alloys during heat-treating and fabricating operations.

603,006 INDUCTION HEATING CORPORATION. Induction heating.

603,064 MUREX WELDING PROCESSES, LIMITED, BISHOP, E., and WILLEY, J. M. Manufacture of flux-coated welding electrodes.

603,123 LONDON ELECTRIC WIRE COMPANY and SMITHS, LIMITED, KELLY, A., and ASHTON, A. B. Production of holes in sintered powdered metal articles.

603,150 STONE & COMPANY, LIMITED, MURPHY, A. J., and PAYNE, R. J. M. Magnesium alloys and the manufacture thereof.

603,162 ELECTROMETALLURGIQUES ALAIS, FROGES and CARMARGUE. Aluminium base alloy.

603,192 STEVENS, A. H. (Mackintosh-Hemphill Company). Production of metal rolls.

603,213 FOUNDRY SERVICES, LIMITED, and STRAUSS, K. Degassing of metals or metal alloys.

603,216 STANDARD OIL DEVELOPMENT COMPANY. Composition for preventing the corrosion of metals.

603,218 MCNEILL, H. L. Method of ore dressing.

603,309 PATELHOLD PATENTVERWERTUNGS- and ELEKTRO-HOLDING, AKT.-GES. Bodies of powdered magnetic material of high permeability.

603,313 SUPERHEATER COMPANY, LIMITED, and RUDORFF, D. W. Metallic impregnation of tubular members.

603.329 NORLINDH, S. E. M. Metal-rolling mills.

603,348 ANDERSON-GRICE COMPANY, LIMITED, PATE, J., PATE, G., and OGG, A. C. Stone-cutting machines.

603,356 FAIREY AVIATION COMPANY, LIMITED, WELHAM, G. L. F., and HILL, H. Machines for bending metal strips.

603,366 ORKLA GRUBE-AKTIEBOLAG. Process of extracting iron from iron silicates or iron ores containing silica.

603,382 HOLDEN, A. DE F. Hollow electrodes for salt bath furnaces.

Personal

MR. ROLAND HOOD has been appointed managing director of W. L. Paynter, Limited, mechanical engineers, etc., of Newcastle-upon-Tyne, in succession to the late Mr. W. L. Paynter.

MR. K. J. MCKILLOP, secretary to the Water Tube Boiler Makers' Association for the last three years, has, in view of his increased responsibilities, been appointed Director of the Association.

MR. A. P. QUARRELL, commercial director of Associated British Oil Engines, Limited, and a director of British Oil Engines (Export), Limited, has left England on a three months' tour of South America and the West Indies.

MR. J. W. CARR, commercial manager of the Park Gate Iron & Steel Company, Limited, Rotherham, retired recently after 50 years with the firm. He started work with the company as an office boy. Mr. Carr received presentations on his retirement.

MR. G. I. RUSHTON, general works manager, DR. BRYNMOR JONES, chief metallurgist, MR. E. K. HUGHES, commercial manager, and MR. A. BLACKBURN, chief accountant, have been appointed special directors of the Whitehead Iron & Steel Company, Limited, Newport, Mon.

MR. E. E. G. ODDS and MR. FITZHERBERT WRIGHT have been appointed deputy managing directors of Aveling-Barford, Limited, road-machinery manufacturers, etc., of Grantham. MR. E. R. HOWLETT, works manager, and MR. C. J. RITCHIE, general sales manager, have been appointed to the board of the company.

SIR FREDERICK WHYTE has tendered his resignation as chairman of Vactric, Limited, electrical and mechanical engineers, of Cricklewood (London, N.W.2) and Chapelhall (near Airdrie), for health reasons. It is proposed that he shall be elected president of the company and that MR. JAMES PATERSON shall be appointed chairman.

MR. ARTHUR DYSON has retired from the position of joint managing director of Horseley Bridge & Thomas Piggott, Limited, constructional engineers, bridge builders, etc., of Tipton, a position he has held since 1928. He will continue to act in a consultative capacity and will retain his seat on the board. MR. J. W. BAILLIE is now sole managing director of the company.

MR. W. EDGAR HALE, founder and chairman of Hale & Hale (Tipton), Limited, malleable-iron founders, was presented with his portrait in oils by his fellow directors at a private dinner on July 29. Mr. Hale formed the company with his late brother at Walsall 37 years ago, when the staff consisted of three men working in a stable. To-day it has a pay-roll of more than 1,000.

Will

ADDISON, G. T., formerly chief accountant of Babcock & Wilcox, Limited, boilermakers, etc., of Renfrew £5,034

Changes of Name

The following companies have recently changed their names, the new titles being given in parentheses:—

ROGER WINCH COMPANY, LIMITED, Newport, Mon. (Goulds Engineering, Limited.)

REGIONAL RADIATORS, LIMITED, London, W.1. (John Lancaster Radiators (Essex), Limited.)

PROVINCIAL RADIATORS, LIMITED, London, W.1. (John Lancaster Radiators (Surrey), Limited.)

READING RADIATORS, LIMITED, London, W.1. (John Lancaster Radiators (Berkshire), Limited.)

SPRINGWELL SAND COMPANY, LIMITED, London, S.W.1. (Ham River (Engineering), Limited.)

SOUTH COAST SHEET METAL WORKS, LIMITED, Hove. (John Lancaster Radiators (Sussex), Limited.)

BOWLING ENGINEERING COMPANY, LIMITED, Bradford. (Fred Thompson (Bradford), Limited.)

JOHN LANCASTER RADIATORS (SOUTHAMPTON), LIMITED. (John Lancaster Radiators (Hampshire), Limited.)

SUCCESSORS TO LLOYD & RAMSDEN, LIMITED, general engineers, etc., of Nottingham. (Johnson Precision Instruments (Nottingham), Limited.)

Future of Cornish Tin Mining

Speaking at Falmouth last week, Mr. Harold Wilson, President of the Board of Trade, said there were those who looked forward to a new future for Cornish tin mining. No one, however, could say what that future would be. A mining development committee had been set up in Cornwall as the result of representations from those in Cornwall who believed there was more to be got from under the soil than had ever been taken out. He did not know the answer. They must await the report of the committee.

[A report sponsored by the newly formed Cornish Mining Development Association urging the Government to finance drilling to assess the tin and other mineral resources of Cornwall is being submitted to the Ministry of Fuel and Power.]

Steel Shortage Prevents Shipbuilding

It is reported that a broad agreement has been reached between the Londonderry Shipyard, Limited, and the Confederation of Shipbuilding and Engineering Unions on wages and conditions to become operative when the firm commences operations as shipbuilders and shiprepairers. Mr. A. B. Swain, managing director of the company, has stated that there are no hopes of opening the shipyard soon. Since the formation of the company last year steel supplies had not been sufficient to justify the acceptance of business. For the present only shiprepairing will be carried on.

NEW PREMISES have been occupied by the Rishton Welding Company, Limited, at Wood Street, Great Harwood, Lancs. The telephone number is unchanged.

News in Brief

THE BRITISH IRON & STEEL CORPORATION is reported to have purchased for about £4,500 a 1,500-ton mahogany and teak yacht, the Iolaire, which cost £350,000 to build. The vessel is to be broken up.

SEPARATE IMPORT LICENCES are now required for the import of architectural or engineering designs where payment is involved. Those of no commercial value may continue to be brought in without restriction.

WALLASEY COUNCIL has decided to place an order with William Denny & Bros., Limited, Dumbarton, for the construction of a twin-screw Diesel-electric passenger ferry vessel at an estimated cost of £256,000.

THE DIRECTOR OF SUNDRY MATERIALS, Board of Trade, has announced that the price of calcium carbide distributed through the Carbide Distributing Agency, Limited, was increased by £1 15s. per ton from August 1.

STEEL & COMPANY, LIMITED, Sunderland, has concluded an agreement to supply 50 mobile cranes, worth £200,000, to the Yugoslav State agency. The order follows a recent visit to Yugoslavia by Mr. James Steel, a director of the company.

THE BUSINESS of Thomas Withers & Sons, Limited, manufacturers of safes, of West Bromwich, was founded 93 years ago, and to mark the firm's jubilee as a limited company, presentations of National Savings certificates were made to employees in proportion to their length of service with the firm. The company is stated to be exporting 90 per cent. of its output.

AN IRON AND STEEL COMPANY, Société Usinor, was recently formed in France, which is stated to own more capital than any other French industrial company. The new company was subscribed to by the Société des Hauts Fourneaux, Forges et Aciéries des Denain et d'Anzin, and by the Société des Forges et Aciéries du Nord et de l'Est. The total capital is reported as 12,000 million fcs. (about £13,873,000).

DORMAN, LONG & COMPANY, LIMITED, Middlesbrough, is carrying out tests with a quarter-scale model of the all-welded girders weighing 100 tons, which are to be used in the building of a gantry for the Steel Company of Wales, Limited. The girders are stated to be almost twice the weight of any welded girder previously made in this country; they will be carried from Middlesbrough to South Wales in sections.

THE ANNUAL MEETING—the 110th—of the British Association for the Advancement of Science will be held at Brighton from September 8 to 15. The British Association, which was founded in 1831, held its only previous meeting in Brighton 76 years ago. This year's president is Sir Henry Tizard; the title of his presidential address will be "The Passing World." The meeting is expected to have an attendance of some 3,000.

METAL SECTIONS, LIMITED, Oldbury Birmingham, a subsidiary of Tube Investments, Limited, has received a contract for 225 sets of pre-fabricated omnibus skeleton components. Consignments of these skeletons have already been sent to Argentina, Brazil, Australia, South Africa, New Zealand, Egypt, and Spain. A single-deck 'bus skeleton can be assembled in 12 man-hours, and a 20 per cent. reduction in the weight of the vehicle is achieved.

THE X-RAY research and production interests of Metropolitan-Vickers Electrical Company, Limited, are being joined with the activities of the Victor X-ray Corporation, Limited, and Newton & Wright, Limited, X-ray engineers, of Finchley, London, N.3, in a new company to be named Newton Victor. The new concern will be the largest British enterprise wholly devoted to the design, manufacture, distribution and servicing of X-ray and electro-medical equipment.

THE DIRECTORS OF Vactric, Limited, electrical and mechanical engineers, of Cricklewood, London, N.W.2, and Chapelhall, near Airdrie, subject to ratification by the shareholders, have concluded with the Treasury an agreement under which an advance to the company will be made of £500,000 in accordance with the provisions of Section 4 of the Distribution of Industry Act, 1945. The loan will bear interest at the rate of 4 per cent. per annum, and be repayable within five years. In addition, the company will have overdraft facilities from its bankers up to £250,000.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained.

Bedlington, August 20—Supply of cylinders, cisterns, plumbing materials, rainwater goods, copper boilers, etc., for the Urban District Council. Mr. W. Hall, engineer and surveyor, Council Offices, Bedlington.

Liverpool, August 30—Supply of approx. 57 tons of 39-in., 32-in., 9-in. and 6-in. cast-iron pipes and special castings (Contract 9), for the Town Council. The Water Engineer's Office, 55, Dale Street, Liverpool, 2. (Fee £3 3s., returnable.)

Liverpool, September 6—Supply and fabrication of the girder work and steel or cast-iron platforms required for four screening chambers to be constructed in concrete, for the Corporation. The Water Engineer, 55, Dale Street, Liverpool, 2. (Fee £3 3s., returnable.)

Llanelly, August 19—Construction of approx. 3,750 yds. of 4-in. dia. spun-iron water main, for the Rural District Council. Mr. D. C. Samuel, engineer, Castle Buildings, Llanelly. (Fee £5, returnable.)

Salisbury, September 11—Supply of iron castings, etc., for the City Council. Mr. H. Rackham, acting city engineer, The Council House, Bourne Hill, Salisbury.

Stoke-on-Trent, August 31—Construction of approx. 350 yds. of 36-in., and 50 yds. of 30-in. dia. cast-iron pipe sewer; and 1,560 yds. of 36-in., 1,010 yds. of 30-in., and 70 yds. of 18-in. dia. concrete pipe sewer, etc., for the Corporation. The City Engineer and Surveyor, Town Hall, Stoke-on-Trent. (Fee £5, returnable.)

West Kesteven, August 31—Provision and laying of about 530 yds. of 10-in. and 1,900 yds. of 3-in. dia. iron pipe water mains, for the Rural District Council. Elliott & Brown, Stanley House, Pelham Road, Nottingham. (Fee £3 3s., returnable.)

Increases of Capital

Details of capital increases have been announced by the following companies:—

WILLIAM SMITH TOOL & STEEL COMPANY, LIMITED, Sheffield, increased by £49,000, in £1 ordinary shares, beyond the registered capital of £1,000.

G. & D. DONALDSON, LIMITED, mechanical, electrical, etc., engineers, of Kirkby, Lancs, increased by £500, in £1 ordinary shares, beyond the registered capital of £1,000.

JOHN LANCASTER RADIATORS, LIMITED, London, W.1, increased by £5,500, in £1 5 per cent. cumulative redeemable preference shares, beyond the registered capital of £1,500.

GUEST, KEEN & NETTLEFOLDS, LIMITED, Smethwick, Staffs, increased by £3,000,000, in £1 4½ per cent. third cumulative preference shares, beyond the registered capital of £20,000,000.

BARKING BRASSWARE COMPANY, LIMITED, Barking, increased by £20,000, in £1 shares, beyond the registered capital of £3,000. At February 11, 1948, Selected Industrial Holdings, Limited, held 2,995 shares of £1 out of 3,000 issued.

CROMPTON PARKINSON, LIMITED, manufacturing and electrical engineers, of Guiseley, Yorks, and Chelmsford, Essex, increased by £850,000, in 3,400,000 "A" ordinary shares of 5s. (to be converted into stock when fully paid), beyond the registered capital of £2,000,000.

PARKWOOD ENGINEERING COMPANY, LIMITED, electrical and general engineers, etc., of Sunbury-on-Thames, increased by £4,000, in 2s. ordinary shares, beyond the registered capital of £1,000 in 900 6 per cent. cumulative preference shares of £1 and 1,000 ordinary shares of 2s.

MERCURY INDUSTRIES (BIRMINGHAM), LIMITED, bicycle manufacturers, engineers, founders, etc., of Regent Street, London, W.1, increased by £5,600, in 4,000 redeemable "A" preference and 1,500 redeemable "B" preference shares of £1 and 2,000 "D" ordinary shares of 1s., beyond the registered capital of £3,000.

CREAMERY PACKAGE MFG. COMPANY, LIMITED, dairy engineers, etc., of Clerkenwell Green, London, E.C.1, increased by £50,000, in £1 shares, beyond the registered capital of £50,000. On April 19, 1948, Parnall & Sons, Limited, of Birmingham, held 24,998 shares, and W. & T. Avery, Limited, of Birmingham, held 25,000 shares.

MR. BASIL PERRY, who since the end of the war has been associated with his father's patternmaking firm, G. Perry & Sons, Leicester, sailed in the Queen Mary on Saturday for America, where he will spend six months working in patternshops and foundries and studying American production methods.

MR. RICHARD H. TURK, president of the Pemco Corporation, Baltimore, Maryland, U.S.A., has been chosen the official representative of the Porcelain Enamel Institute to the International Congress on Porcelain Enamelling to be held in London from September 28 to 30.

C.M.A. Reorganisation

New Position of Constituent Sections

The constituent sections of the Cable Makers' Association which deal with particular branches of manufacture have been established as autonomous manufacturers' associations. These associations will be affiliated to the C.M.A., and each will deal directly with all commercial and technical matters falling within its ambit. Thus, the commercial activities which, in the past were undertaken by the C.M.A., will henceforth be discharged by the different affiliated manufacturers' associations.

The chief of the affiliated associations are as follow:—Mains Cable Manufacturers' Association; Mains Cable Manufacturers' Association (Super Tension); Rubber and Thermoplastic Cable Manufacturers' Association. The affiliated manufacturers' associations will be housed at the offices of the Cable Makers' Association, High Holborn House, 52-54, High Holborn, London, W.C.1.

The C.M.A., as hitherto, will deal with research, standardisation, testing and certification of its members' products, industrial relationships, education and training of personnel, co-operation with kindred associations and with subjects of a policy nature. Mr. P. V. Hunter is the chairman of the C.M.A. for the current year, while Mr. E. H. Wale has been appointed secretary on the retirement of Mr. W. G. Stiles.

Limestone Supplies Assured

An assurance of probably being able to meet all requirements during the coming 12 months has been given to the Government by the Limestone Federation.

Earlier this year the Federation drew the attention of the Government to the possibility of heavily reduced production in view of the loss of labour from limestone quarries during the past few years and pointed out that the effect of this depletion in man-power was likely to reach serious proportions on the withdrawal of German prisoner-of-war labour. Talks between the Federation and the Government followed, with the result that there has been a steady improvement in the provision of fuel, British and foreign labour, and a speeding-up of the mechanisation of quarries.

Obituary

MR. G. H. TAYLOR, Midland representative of the Marco Conveyor & Engineering Company, Limited, Leytonstone, London, E.11, died recently.

MR. PERCIVAL JOHN PURDY, formerly of the Purdy Patent Machinery Company (1930), Limited, London, N.W.1, died recently at Los Angeles, California.

MR. WILLIAM L. PAYNTER, managing director of W. L. Paynter, Limited, mechanical engineers, etc., of Newcastle-upon-Tyne, has died at the age of 71.

Company News

(Figures for previous year in brackets.)

Hadfields—Interim dividend of 5% (same).

Shanks & Company—Interim dividend of 5% (same).

Parmiter, Hope & Sugden—Dividend of 30% (same).

Padley & Venables—Interim dividend of 50% (same).

Linley Engineering Company—Dividend of 10% (same).

Burnell & Company—Interim dividend of 7½% (same).

Falk, Stadelmann & Company—Interim dividend of 10% (same).

George Kent—Final dividend of 6% (7%), making 10% (same).

Steel & Company—Final dividend of 10%, making 17½% (same).

Wellman Smith Owen Engineering Corporation—Final dividend of 7½%, making 12½% (same).

Larmuth & Bulmer—Net profit for the year ended March 31, after tax, depreciation, etc., £6,327 (£7,476); final dividend of 10% (12½%), making 15% (same); forward, £14,878 (£18,872).

B. Elliott & Company—Trading profit to March 31, £138,894 (£119,868); to depreciation, etc., £93,609 (£79,522); final dividend of 66⅔%, making 100% (same); forward, £158,615 (£141,172).

Burt, Boulton & Haywood—Second interim dividend of 2½%, making 5½% for the nine months to March 31. No further dividend for the period (against a dividend of 7% for the previous 12 months).

Aluminium Castings Company—Dividend of 20% on the ordinary shares (final dividend of 25%, making 32½%); dividend of 11⅔% on the preferred ordinary shares (final dividend of 8⅓%, making 15⅝%).

Davy & United Engineering Company—Net profit for the year ended March 31, after tax, etc., £97,787 (£47,492); dividend of 7½% (same); to replacement reserve, £30,000 (nil); general reserve, £50,000 (nil); forward, £77,096 (£98,135).

Metal Industries—Profit for the year ended March 31, £508,119 (£291,874); to taxation, £230,213 (£146,959); directors' fees, £2,600 (£2,325); final dividend on the "A" and "B" ordinary shares of 7%, making 10% (same); forward, £194,520 (£97,440).

Banister, Walton & Company—Net profit for the year ended March 31, £70,924; less losses of subsidiaries, £17,869; to taxation, £37,754; directors' fees, £2,000; final dividend of 20% and bonus of 5%, making 30% (same); forward, £53,218 (£41,503).

Cozens & Sutcliffe (Holdings)—Consolidated profit to June 30, £51,022; to remuneration and fees, £6,278; depreciation (none on freehold premises), £5,358; taxation, £22,825; dividend of 25% (same); forward, £35,489 (£34,642). In future dividends will be paid half-yearly.

Electric Construction Company—Net profit to March 31, after reserving £15,000 (nil) for contingencies and £20,000 (nil) against value of stock, £98,405 (£58,320); to tax, £71,500 (£30,000); superannuation, £5,000 (£2,000); general reserve, nil (£9,911); dividend of 12½% (same); forward, £37,203 (£39,773).

Rippingilles—Trading profit to March 31, £23,424 (£11,154); investments income, £36 (nil); to depreciation, £2,280 (£2,179); directors' remuneration, £4,675 (fees, £300); profits tax, £2,700; income tax, £6,596 (taxation, £3,785); dividend of 7½% (same); general reserve, £2,500 (same); forward, £4,693 (£4,409).

Summerlee Iron Company—Profit for the year to February 29, including provisional income, £5,186, plus £51,930 adjustments applicable to earlier years; after proportion of preference dividend for the half-year to August 31, 1947, and payment for the half-year to February 29 last, the debit forward is reduced to £6,233 (debit, £61,534).

John Booth & Sons (Bolton)—Net trading profit to March 31, after deducting £40,253 for expenses and profits tax, £76,254; to stamp duty on bonus shares, £37,510; additional income tax for 1946-47, £6,391; adjustments on contracts completed March 31, 1947, £3,475; income tax to March, 1948, £34,500; final dividend of 15%, making 25%; to reserve, £10,000; forward, £71,873 (£70,231). Reconstruction of the company's capital was effected on June 30 of last year.

Vactric—Net loss for the year ended March 31, £21,004; after adjusting for war contracts the loss was £33,717 (trading profit, £126,588); after bringing in dividend receivable from subsidiary company, providing for tax and deducting the balance brought in (less preference dividend for six months ended September 30, 1947) accumulated loss, £30,952 (net profit, £101,672); group loss for year, £13,398; after appropriations and including balance brought in accumulated loss carried forward, £9,543. The preference dividend for the half-year to March 31 was not paid and the directors cannot recommend an ordinary dividend.

New Companies

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Smith's Diecast Products, 151-3, Edmund Street, Birmingham—£5,000.

Clavell Foundries, Abbey House, Victoria Street, London, S.W.1—£8,000.

Earlsfield Non-ferrous Foundry, 27, John Adam Street, London, W.C.2—£5,000. F. H. and A. E. Boardley.

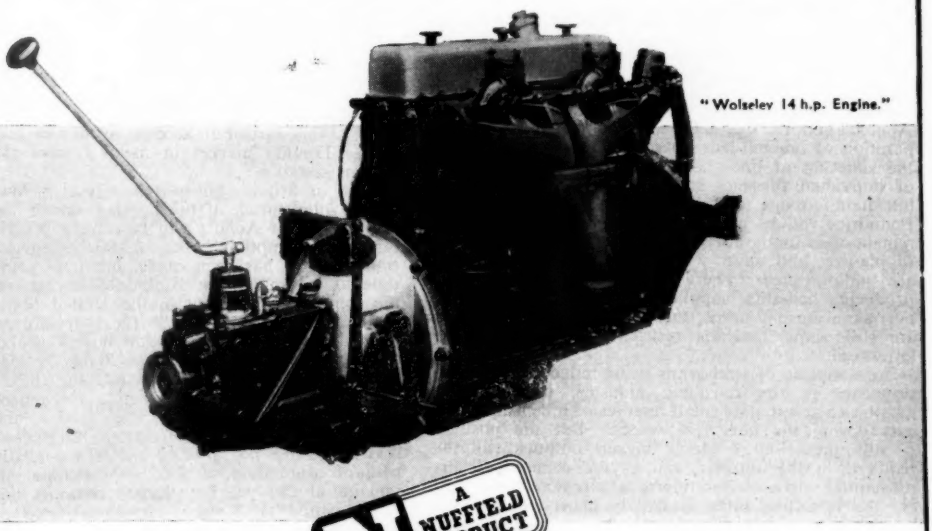
J. Broughton & Son (Engineers), Security Works, Vere Street, Birmingham—£20,000. J. and G. J. Broughton.

Thos. Storey (Engineers), Vernon Works, Mersey Street, Stockport—£50,000. T. Storey, M. Radvien, and C. Hornby.

A. E. Downing & Company, Spon Lane, West Bromwich—Brass and iron founders, etc. £5,000. E. M. Blundell and J. F. Loach.

T. Baker & Sons (Newbury), 3, Cork Street, Reading—Agricultural engineers. £15,000. D. T. Baker, J. Seddon, and A. C. Brading.

Wm. Waller & Son—Manufacturers of iron, steel and other metals. £5,000. H. Waller, 308, Skipton Road, Keighley, Yorks, subscriber.



"Wolseley 14 h.p. Engine."

A NUFFIELD PRODUCT

Using

STANTON-DALE

REFINED PIG IRON

USED AND RECOMMENDED
FOR ALL HIGH-DUTY
ENGINEERING CASTINGS

THE STANTON IRONWORKS COMPANY LIMITED, Nr. NOTTINGHAM

Raw Material Markets

Iron and Steel

The upward trend of pig-iron production continues, but the supply has not yet fully overtaken the demand, and it is hoped that by the autumn there will be a further increase in the number of furnaces in blast. Appreciation of the need for a more thorough preparation of ore burdens—particularly native ores—and the sintering of fines has helped to swell the output of individual furnaces and reduce coke consumption, but there is scope for further advances in this direction. Foundries will be using less iron this month, but will remain open for the acceptance of their normal deliveries of pig-iron and scrap, while steelmakers' requirements are undiminished. There are now 15 blast furnaces producing hematite, supplies of which have probably overtaken current needs, but foundry and forge irons are still scarce and the restrictions on delivery are unrelaxed.

Consumption of steel semis being reduced by holiday stoppages in the re-rolling industry, it should be possible to accumulate small reserves of billets and sheet bars during the next few weeks. But the position is still precarious. Much bigger outputs will be required in the autumn, and as the chances of any substantial increase in imports are remote, operation of the re-rolling mills is largely dependent on the extent of deliveries of home-produced semis.

The demand for almost every class of finished steel is far in excess of rolling-mill capacity, and the Control Board is not only rejecting all applications for increased allocations, but has adopted effective measures to prevent any deliveries in excess of authorised tonnages. Possibly the position will be reviewed before the allocations for Period IV are issued, but, in the meantime, works are regularly clearing their outputs, and export quotas are restricted, except in the case of some of the Crown Colonies, where some small increases have been sanctioned. Plate and sheet mills have very heavy commitments and rail mills are working to capacity, but pressure for maintenance material for the collieries is slightly relaxed.

Non-ferrous Metals

Last week the American copper producers raised their selling limit to 23½ cents, an advance of 2 cents per lb. on the previous quotation. This move was partially foreseen in the action taken by one of the smaller producers a few days before the advance became general, and there has, of course, been a wages award which has increased costs of production in all the non-ferrous metals. But without the certainty that absolute necessity compelled the increases which have been made in the selling prices of copper, lead and zinc in the United States, it is difficult to understand the extent of the rise. Lead is now some four to five times its pre-war price and, in the somewhat reckless mood now obtaining in America, it is no use pretending that we can be sure that the top of the bull market has been reached. Judging from reports, it would appear that the man in the street, as in this country, is beginning to rebel against excessively high prices and, in due course, this sentiment will spread to buyers of non-ferrous metals. The trouble is, of course, that rearmament and the Government's stockpiling programme are taking up very large quantities of these strategic metals, which holds prices at a very high level. What sort of an account, it may be asked, would a free London market in metal futures give of the present situation?

Here in Britain, business is still at a low ebb due to the intervention of the holiday season, and it does not seem as if August will be a very good month so far as consumption goes. A fairly general resumption of work has been made, but it is going to take time to get much zest back into buying, in spite of the firm tone obtaining in the United States. Scrap has not so far responded to the spur afforded by the strength in virgin metals, for buyers are disinclined to pay more than before the Bank holiday period. In this their judgment is sound, for these fantastic quotations for non-ferrous metals are entirely out of place in the economy of Britain to-day, and can do nothing but harm to the industry. In this connection, it is impossible not to comment on the relative cheapness of aluminium, which, at the time of writing, remains at £80 per ton, despite rumours that an advance would take place. In the United States the price of this metal is now 16 cents.

Enamelled Hollow-ware Prices

The Board of Trade, in consultation with the Central Price Regulation Committee, has made an Order revoking the existing Order (S.R. & O. 1945, No. 1071), which lays down the maximum prices to be charged by distributors of enamelled hollow-ware. The new Order substantially re-enacts the provisions of the revoked Order, but also introduces provisions governing the maximum prices to be charged by importers, wholesalers, and retailers of imported enamel hollow-ware. The importer's and wholesaler's maximum price is fixed at the landed cost together with, on sale otherwise than to a retail customer, 33⅓ per cent. thereof, and on sale to a retail customer, 50 per cent. thereof. The retailer's maximum price is fixed at the price paid to the importer or wholesaler together with 50 per cent. thereof.

The new Order, the Enamelled Hollow-ware (Maximum Prices) Order 1948 (S.I. 1948, No. 1733, price 1d.), came into operation on Monday last.

MR. AND MRS. EDWIN BULLOCK, of Dawley, Salop, celebrated their golden wedding on August 1. Mr. Bullock, a retired foundry foreman, learnt his trade at Coalbrookdale and became a foreman at the age of 25. He later worked with several Midland firms, and for some time was a tutor at Birmingham University.